<Notes>Pioneer Settlements and Water Control Development on the West Bank of the Lower Chao Phraya Delta : Water Conditions in the Deltaic Lowland Rice Fields (II)

AUTHOR(S):

Kaida, Yoshihiro

Southeast Asian Studies, Vol. 11, No. 4, March 1974

Pioneer Settlements and Water Control Development on the West Bank of the Lower Chao Phraya Delta

—— Water Conditions in the Deltaic Lowland Rice Fields (II) ——

by

Yoshihiro KAIDA*

In the previous paper by the present writer[1], the Chao Phraya Delta was subdivided into five zones based on the hydrographical conditions; namely, (1) Main Area of the Old Delta, (2) Chains of Depressions, (3) Retarding Basin of the Delta, (4) Poldered Flat Delta, and (5) Knotty River Area of the Coastal Zone.[1] In this paper, special emphasis is placed upon the historical development of water control activities in two of the above zones, the Retarding Basin of the Delta and the Poldered Flat Delta on the west bank of the Chao Phraya river. The boundaries of the study area dealt in this paper are the Suphanburi-Angthong line on the north, the Suphan river on the west, the Mahachai canal on the south, and the Chao Phraya river on the east.

Hydrographical Setting of the Study Area [1]

The northern half of the area is in the Retarding Basin of the Delta whose hydrographical condition is characterized by the abrupt surging of deep water inundation in the later part of the rainy season, vis. from late October to November, and even towards December. The maximun depth of water on the fields attains 60–120 cm, with certain spots occasionally exceeding 200 cm. This deep inundation is primarily due to the drained water from the Old Delta through the numerous chains of depressions. Rice cultivation of so-called broadcast tall variety, the floating rice as an example, has been the only feasible way of adapting to the given water condition.

The southern half of the area is in the Poldered Flat Delta whose water condition is characterized by shallower inundation with comparatively slower increasing rate of water depth than that of the northern part of the area. At present this area is crisscrossed with the networks of man-made primary, secondary and tertiary canals, which makes even the cultivation of the early season rice possible in an extensive acreage.

But here, note that the undisturbed status of this lowland in general, under monsoon climate, is a kind of amphibious one in nature.[2] Because of its flatness and

* 海田能宏, The Center for Southeast Asian Studies, Kyoto University

low elevation, the entire region shifts from one extreme to the other corresponding to the climatic ossilation; such as total submergence under water during the wet season to total parching of land during the dry season.

Inspection of the detailed contour map[3] reveals no sharp demarcation of topography between the northern and the southern part of the area. The general slope of land in a north-south direction is extremely flat with average elevation of ca. 1.5 m above mean sea level, and a general slope of ca. 1/20,000, though the elevation increases as one goes farther inland. A huge swaley area seems to lie in the northern part of the West Bank Tract of the present irrigation project south of the Bang Yeehon canal. General water conditions appear to be demarcated at the Phraya Banluu canal running in an east-west direction. Therefore, it may be considered that the hydraulic gradient in the area should be more regarded as determining the general water conditions in the fields rather than the topographical gradient of the area.[4] More detailed discussion of the water regime in the area will be presented in the following paper of this series.

Historical Development of the Water Control Activities

1. A Brief Note on the History of Canalization in the Lower Delta

The first human activities to control the deltaic Chao Phraya river were supposedly initiated during the Ayutthaya period with the canalization of the river at the section between Ayutthaya and the river mouth. It was primarily aimed at improving the navigability of this stretch of the river. Water works at those times meant the "short cutting" of meandering portions of the river to reduce the distance of boat navigation to Ayutthaya.[5]

After the capital was moved to Bangkok in 1782, several canals of an east-west direction connecting the Chao Phraya river with other trunk rivers in the lower Delta were dug: the Saen Saeb-Bang Khanak canal (1837-40) and the Phrakhanong-Prawet Burirom canal (1878-80) between the Chao Phraya and the Bang Pakong, the Mahasawat canal (1861-65), the Phasi Charuun canal (1867), the Phra Phimol canal (1890-?) and the Phraya Bangluu canal (1892-?) between the Chao Phraya and the Suphan, the Sunak Hawn canal (1829) and Damnuun Saduak canal (1867-68) between the Suphan and the Maeklong. The major purpose of canalization at this time was to connect the area of production of certain commodities such as sugar cane, rice, dried fish, charcoal, etc., to the marketing center, Bangkok, by navigable water courses. Canals were the primary transportation routeways.[6,7,8]

It was commonly believed that the potential of the lower Delta area as a huge rice granary was not fully exploited until the 1850's, although a small number of pioneer settlers had been employing themselves in agriculture by this time. After

1856, however, when the trade was liberated by the Bowring treaty, rice began to be considered as the most important exporting commodity to the neighboring colonized countries. It was after 1850's that the Delta began to be realized as a potential area for rice-plantation. From the turn of 1880, private sectors such as high ranking officials of the King, nobles, and later, a private company, the Siam Canals Land and Irrigation Company, made heavy investment in the canalization of the lower Delta in order to control water for rice cultivation. A very extensive area in the lower Delta was reclaimed into paddy rice land between 1880 and 1900. This fact was reflected in the sharp increase of the quantity of rice exports after 1880.[9] The major motivation of investors of those days was the acquisition of the land title of zones along the canal which they built. For example, in a contract made between the government and the private company in 1888, the pioneer investor secured the land title for the zone of 0.8 km wide on either side, 1.6 km wide including both sides, along his canal.[7] The newly reclaimed land was shared among the King's family, or was sold to landlords. Then a great number of rice growers, most of them tenant farmers, began to settle along the canals.

The canal system was essential for those quasi-commercial growers of rice in the area, since the transportation of their products was totally impossible unless they could have perennially navigable water courses. A canal as a means of controlling irrigation and drainage for rice cultivation had been pronounced minimal by around 1900.

2. Agriculture and Human Settlements before 1910's

Careful inspection of the maps of scale 1/50,000, whose survey was made during the period 1915-1920 revealed many interesting facts.[10] Settlement patterns of those days and the development of canalization will be discussed here. On the map we can distinguish six different settlement patterns as illustrated in Fig. 1.

(A) Ribbon type settlements along natural levees (Fig. 1-A)

The most striking feature which arrests our eyes on the map is the very densely inhabited ribbon type settlements along the rivers, which Sternstein named continuous line settlements.[11] They are along the natural river levees of the major trunk rivers such as the Chao Phraya and the Noi between Singburi and Ayutthaya; and the entire stretch of the Suphan between Samchook and the point of the confluence of the Song Phinong. Secondary distributaries of the Chao Phraya near Angthong and Song Phinong are also occupied by the same pattern of settlements. Notice that the banks of non-perennial streams are carefully avoided as living sites. Width of the natural levees where they have no threat of deep inundation throughout a year varies from ca. 2 km to ca. 100 m. In most places, levees are covered by dense and giant canopies of evergreen trees such as rain tree, "makaam" tree bamboo bushes, and many garden trees of various variety and size. Houses are hidden within those

greens. Boat traffic is busy in the perennial rivers to which villagers' front doorways face. Their common agricultural practices seen to be a combination of rice growing in the backswamps and garden culture of fruit and vegetables on the levees. This type of settlement pattern and its agricultural practices are supposedly typical of the Siamese peasant. The river bank, in the section along Singburi-Angthong-Ayutthaya, surely used to be the cultural center with regard to population and agrarian culture as well as riverine culture.

(B) Scattered clustered hamlets with dendric natural streams (Fig. 1-B)

Type B settlements are seen mainly in the deep water rice area Southwest of Phakhai. Small hamlets of 10-15 households face a creek-like stream. The village site is on a slight mound along a creek, though elevation difference doesn't exceed ca. 1 m. Houses are on logs more than two meters long; even cattle huts are so elevated for fear of total submergence under water in the rainy season. The area is totally in the mood of a water-scape. The major agricultural activities might have been a combination of floating rice cultivation in flat swaley field and fresh water fishing in the streams. Type B is assumed to be one type of an extention of the Type A settlement.

(C) Ribbon type settlements along man-made canals (Fig. 1-C)

The origin of this type of settlement is very clear. The first settlers came to settle as semi-commercial growers of rice soon after the trunk canals had been constructed in 1850's-1900's. They were mostly tenant farmers totally specialized in rice growing. The houses face a trunk canal and behind them is an extensive terrain of very flat rice fields. Many comb-like creeks observed in Fig. 1-C are small waterways for irrigation-drainage-access way to fields purposes which were dug through their own efforts. Trees must be planted on the narrow banks of the artificial canals, usually ca. 10 to 20 m wide, as no trees can grow under submergible conditions.

The scene of the villages in those early days of settlement might be greyish, muddy and bare in the rainy season, and whitish and totally parched in the dry season, which must be a sharp contrast to type A villages.

Type A, B, and C are strongly oriented to riverine water communication which must be the essential means for their access to a market place. Rivers, canals, and streams should be less regarded as a means of water control for irrigation and drainage of rice fields by this time.

(D) Separate clustered villages with ponds on Fan-Terrace Complex (Fig. 1-D)

Type D settlements are seen on the Fan-Terrace Complex on the right bank of the Suphan river. The settlement and its rice cultivation are characterized by ubiquitous ponds in the village area or in the fields. The pond, or more scientifically the water-collecting pond-like well, is essential for getting water for domestic use and

Key to Figs. 1

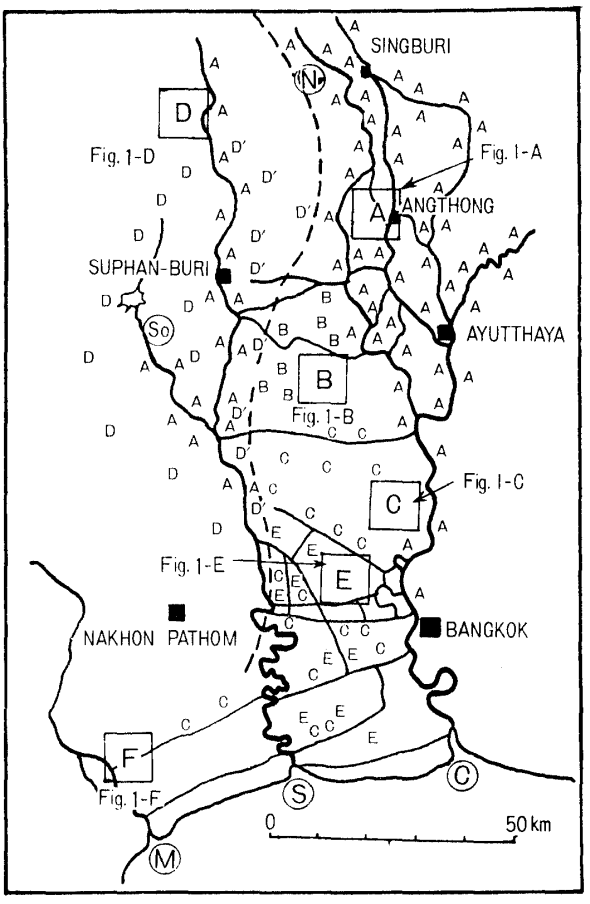


Fig. 1 Settlement patterns on the west bank of the lower Chao Phraya Delta

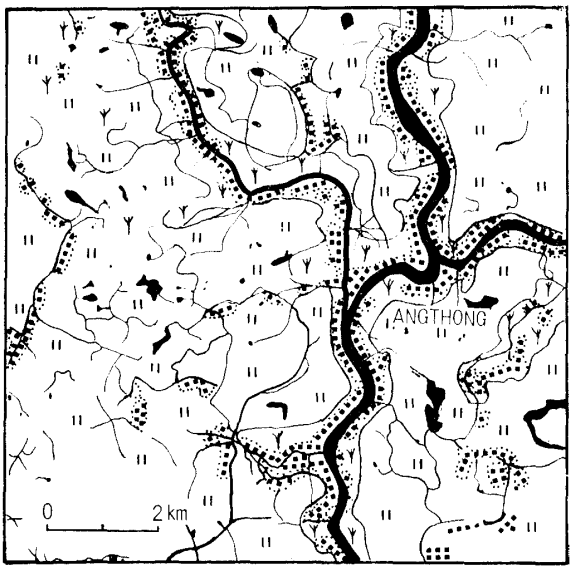


Fig. 1-A Ribbon type settlements along natural levees (Type A)

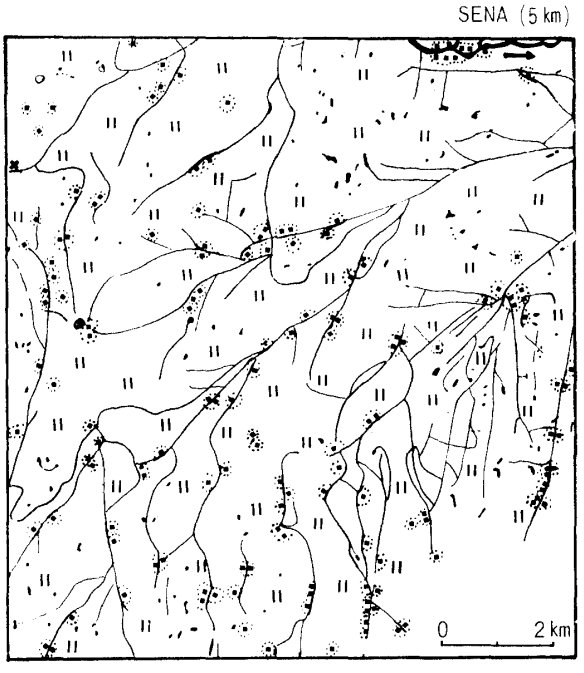


Fig. 1-B Scattered clustered hamlets with dendric natural streams (Type B)

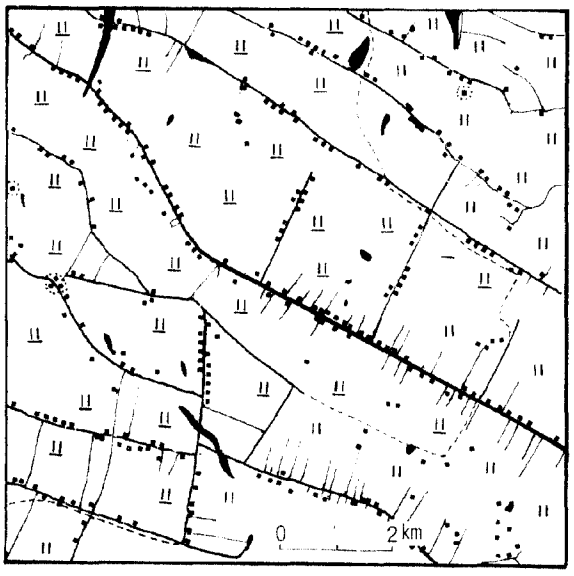


Fig. 1-C Ribbon type settlements along man-made canals (Type C)

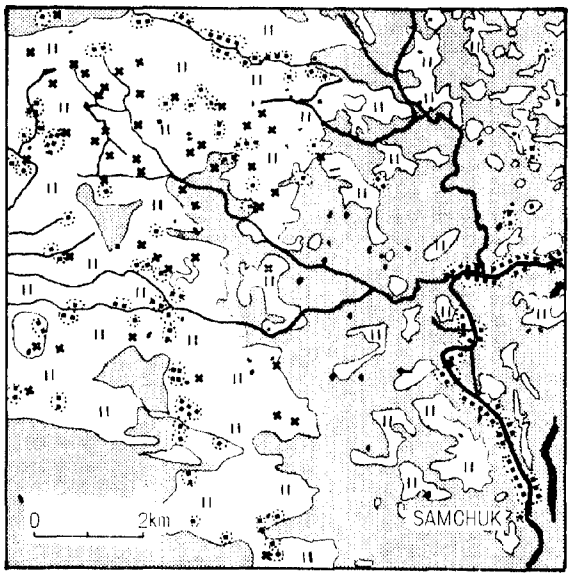


Fig.1-D Separate clustered villages with ponds on Fan-Terrace Complex (Type D)

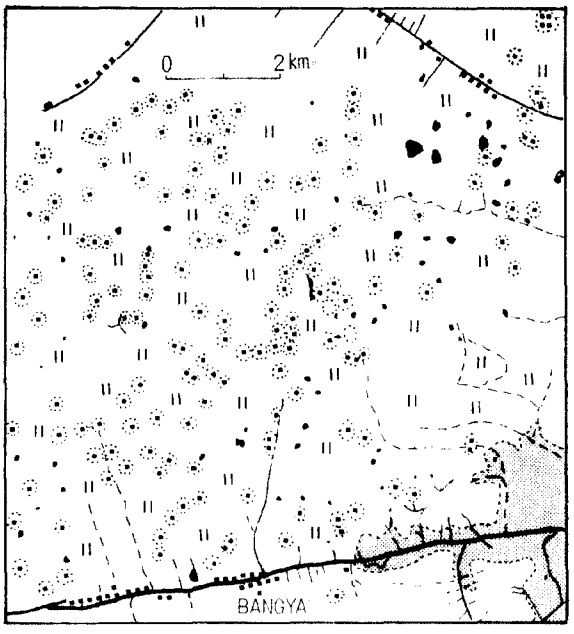


Fig. 1-E Dispersed single houselots with ponds in the lower Delta (Type E)

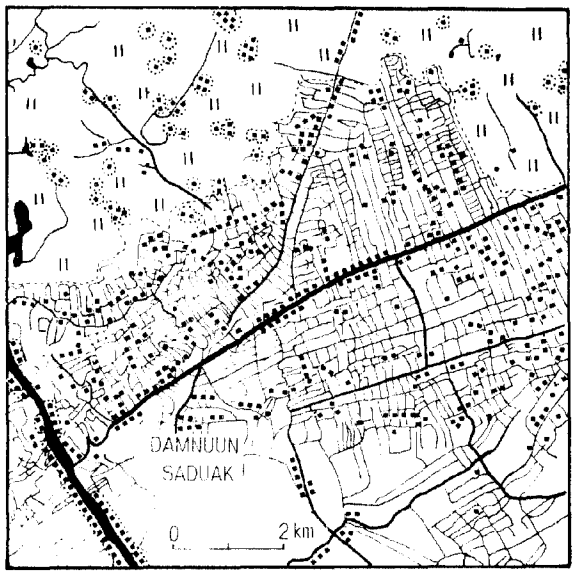


Fig. 1-F Chinese settlements of fruit and vegetable growers in the tidal Delta (Type F)

for irrigating water for rice nursery, as this area is on the water-deficient foothill.[12] The village looks like a green islet with tall evergreen trees and garden trees, the houses being hidden in them. Takaya presumes that this type of settlement and rice cultivation is typical of Mons.[13]

(E) Dispersed single-houselot with pond in the lower Delta (Fig. 1-E)

The map shows many dispersed single-houselots, as Sternstein first pointed out,[11] scattered in the lower Delta in between the Phra Phimol canal and the Yong canal. The same type of houselot is also marked on the map, though not of the same density, farther south near the Mahachai canal and the present rail line or farther north on the left bank of the Suphan as illustrated in Fig. 1. A single-houselot does not always have an access stream to lead to a major communication canal. But instead, without exception, each household has a pond surrounding or near his house, and the house is sometimes built on an embanked mound. Note that from the map it appears that the canal layout cautiously avoids this type E area. This fact might be understood if we presume as follows: it would be of no value for a pioneer investor to dig a canal through the type E area as he would not be eligible to acquire a land title in the land already inhabited by those lonely dwellers. Therefore, the writer tentatively presumes that the pioneer settlers in the lower Delta were most probably those who lived isolated in the type E settlement. The period of their settlement, however, is unknown.

The type D settlement characterized by the small ponds (*boo*, or *sa* in Thai) appears to extend farther south into deltaic region as indicated by a dotted line in Fig. 1. The writer further assumes that the type E settlement is the farthest extension of the type D towards the deltaic area, the pond being a key factor for the presumption. It is commonly thought that the lower Delta is an aqueous territory of flooding and total submergence. But this concept is wrong in a sense. Note that the area where our isolated delta dwellers are living is parched, or at least water-deficient, for as long as nine months a year. Total submergence takes place only for the remaining three months towards the end of the rainy season. Seeking for water is more difficult, especially in streamless areas, than draining excess water. This is true if submergence only occurs for short durations. The ponds, therefore, were an essential pre-condition for dwellers to live in the "Lower Delta". The water regime in the area will be more thoroughly discussed in the next paper.

(F) Chinese settlements of fruit and vegetable growers in the tidal Delta east of Ratburi, (Fig. 1-F)

These settlers are commercial growers of fruit and vegetables, who are thought to have originated from the Chinese laborers employed to dig the Phasi Charuun canal (1867) and the Damnuun Saduak canal (1867-68). They have made up beautiful garden plots out of deltaic clayey soil by canalizing and empoldering the land through their

own individual efforts. One unit of the polder is as small as 1-3 ha. Notice the extremely high density of the canal networks. The bank height usually exceeds 2 m, and the bank is reinforced by planted trees such as mango. Dragon-wheel pumps are extensively used in the area to irrigate and drain water to and from gardens.[14] Houselots are strongly oriented to their garden plots as the gardens need intensive care, the settlement pattern is therefore dispersed.

3. Development of Water Control Activities after 1910's

Since the turn of the twentieth century almost all the construction of water works, especially of irrigation, flood control, and navigation, was transfered to the hands of the national government. It was the Canal Department that first took the responsibility, and then the Royal Irrigation Department undertook all water control enterprises.

In the early 20th century, water works of national level in the deltaic region took place in other parts of the Delta, the West Bank area being neglected until 1939.[15] Therefore, the major framework of the canal systems in 1938 as shown in Fig. 2-1 had maintained the state of early development made by the pioneer investors as well as by the pioneer settlers.

In 1939, RID's undertaking began with the excavation of three trunk canals of north-south direction; namely, Jiphun Nua-Jiphun Tai, San-Laksorn, and the Phra Udom canal. The Thawiiwatthana canal which crosses the already existing Mahasawat and Mahachai canals, was also completed at this time. These trunk canals were intended to disperse the flood water of the northern area as Phakhai towards the Delta Flat downstream. The Thawiiwatthana canal was excavated for the purpose of washing out the silt deposited in the two crossing canals using the water from the Suphan river, since silting up of the canals was the most serious navigation problem.[7] A head regulator (a water-table-regulating-gate) and/or a navigation lock were installed on either ends of the canal, strongly encouraged by then foreign advisers, a Dutch irrigation expert, van der Heide from Netherland Indonesia, and an English irrigation engineer, Sir Thomas Ward from British India.

Though there was a break of progress during and aftcr World War II, the canal system was gradually improved, and by 1960 the system had been made up as shown in Fig. 2-2. Note that the two big feeding canals were newly built—one connecting the Suphan water from the Phophraya head regulator to the Bang Yeehon canal at the northwest part of the West Bank Tract, and the other the Phakhai-Chao Ched canal which stretches from the Noi water at Phakhai head regulator toward the Bang Yeehon canal at the northeast corner of the area. The feeding canals were principally for dispersing the flood waters of the trunk rivers to the West Bank Tract for the safety of the rivers further downstream. The West Bank Tract had been considered as a retarding basin for the whole Delta. Nevertheless, we must know that the two

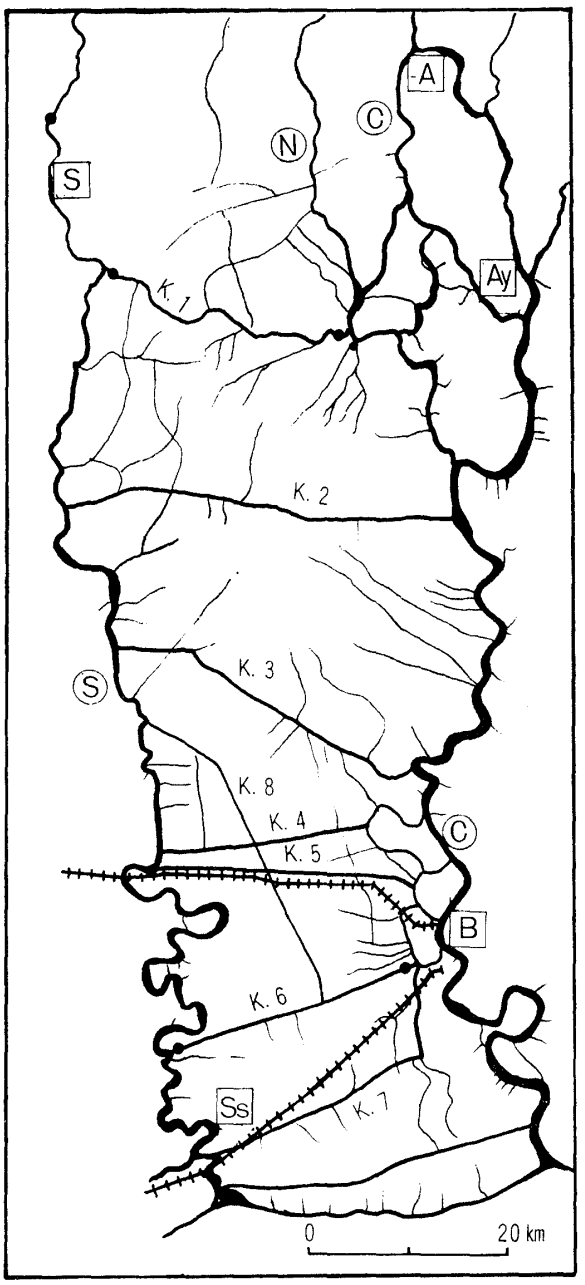


Fig. 2–1 Historical development of canaliza tion in the region as of 1939

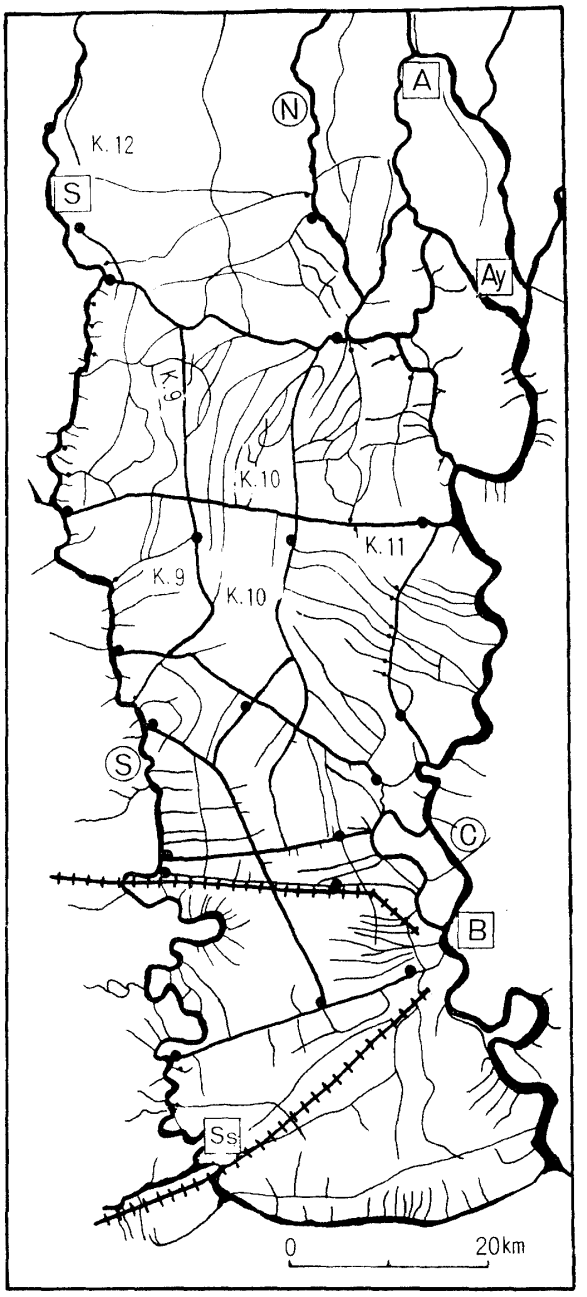
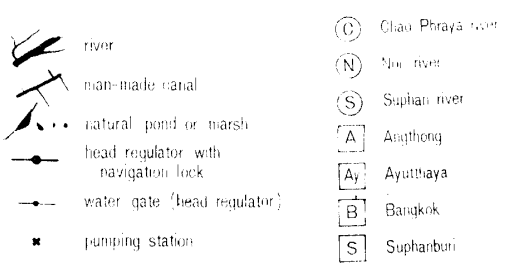


Fig. 2–2 Historical development of canalization as of 1963



K. 1 Bang Yeehon canal
K. 2 Phaya Bangluu canal
K. 3 Phra Phimol canal
K. 4 Yong canal
K. 5 Mahasawat canal
K. 6 Phasi Charuun canal
K. 7 Mahachai canal
K. 8 Thawii Wattana canal
K. 9 Jiphun Nua-Jiphun Tai canal
K.10 San-Lakkhon canal
K.11 Phra Udom canal
K.12 Phokhoi-Bang Yeehon canal
K.13 Phakhai-Chao Ced canal

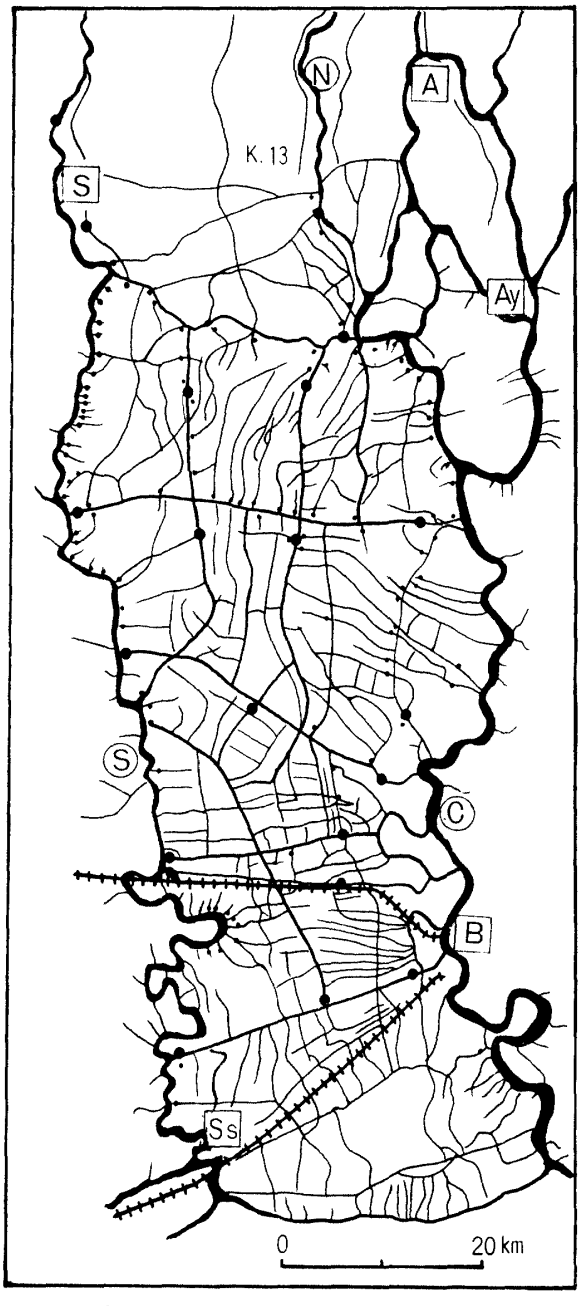


Fig. 2-3 Historical development of canalization as of 1969

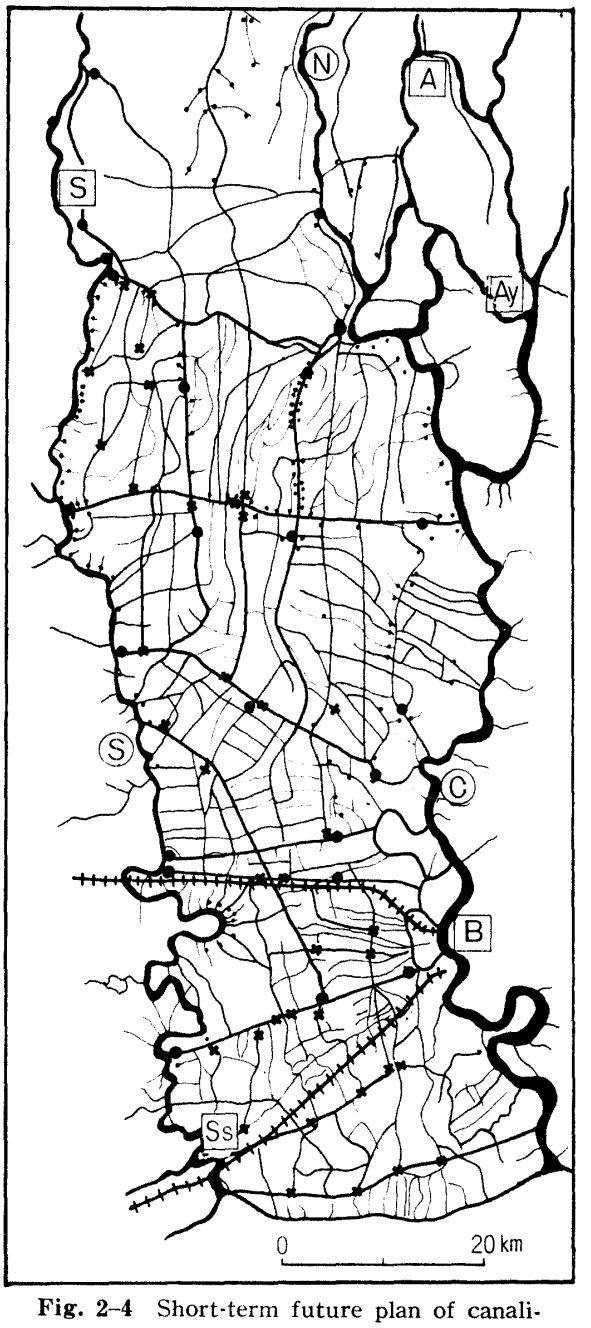


Fig. 2-4 Short-term future plan of canalization by RID (1969-1979)

canals were an essential pre-condition for the later evolution of the early season rice growing after 1960's.

Aside from the major canals described above, there was remarkable progress in implementing the secondary canals, as the RID took up the construction of those minor canals. From major and secondary canals the settlers dug feeder ditches in right angles to the former by their own labors and expenses. The feeder ditch usually extends up to ca. 1 km.

By 1969, more and more secondary and tertiary canal networks were implemented as illustrated in Fig. 2-3. By this time the type E villages were involved in the canalled area, being crisscrossed with secondary canals, and the whole region became fairly homogenized with respect to water conditions. Cultivation of early season rice, or even double cropping of rice, became common in certain areas in the region thanks to the feeding canals which can supply relatively abundant water from the Phumiphol dam far upstream of the Ping river through the Suphan and the Noi rivers. For example, in the dry season of 1973, RID could feed the region with 60 cms (cubic meter per second) water from the Noi and the Suphan, which enabled the cultivation of the early season rice, or the off-season rice, to an extensive acreage of 400,000 rai (64,000 ha) within the West Bank Tract alone.* Another essential factor for this innovation was the installation of small pumps to lift water reserved in the canal. This combination, i.e. reserved water in a canal and a movable pump, seems to be the best tool for the rather individualistic Thai farmer to initiate the reform of agricultural practices.

Embankments along the long stretch of the Bang Yeehon canal and along the Mahasawat canal and the reinforcement of the natural levees of both the Chao Phraya and the Suphan had already been nearly completed by 1970. All the stretches along the main canals in the region were, of course, banked with the soil dredged from the canal beds. Therefore, the West Bank Tract can be said to be a single huge polder bounded by the Bang Yeehon canal on the north, by the Mahasawat canal on the south, by the Suphan on the west, and by the Chao Phraya on the east. We may also remark that the region is composed of nine big sub-polders demarcated by major canals, each of which corresponds to the nine zones in the area, and each zone is again comprised of numerous smaller polders bounded by the secondary and tertiary artificial canals. This is the reason why the writer has named the area "Poldered Flat Delta".[11]

In Fig. 2-4, a future plan of implementing more secured and more complete canal systems is shown. After the completion of this short-term future plan, the water conditions in the region will surely be stabilized and more homogenized, should the flood control in the northern half of the region be possible.

Changing Phase of Rice Culture in the Region

The demarcation of the transplanted and the broadcast rice area is illustrated in Fig. 3. The area affected by occasional crop damage by drought, and then consequently by flooding, is also shown by slashes in the same figure. This map represents

* Personal information from Mr. Leck Jindasnguan, manager of the Water Operation Board and Center, RID.

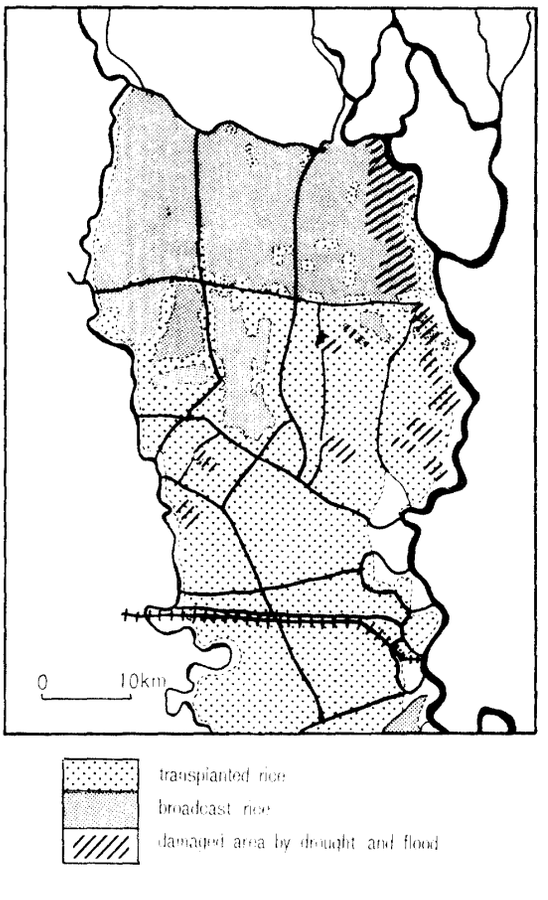


Fig. 3 Transplanted and broadcast rice area in the West Bank Tract

Source : Sukit Visuwan, RID

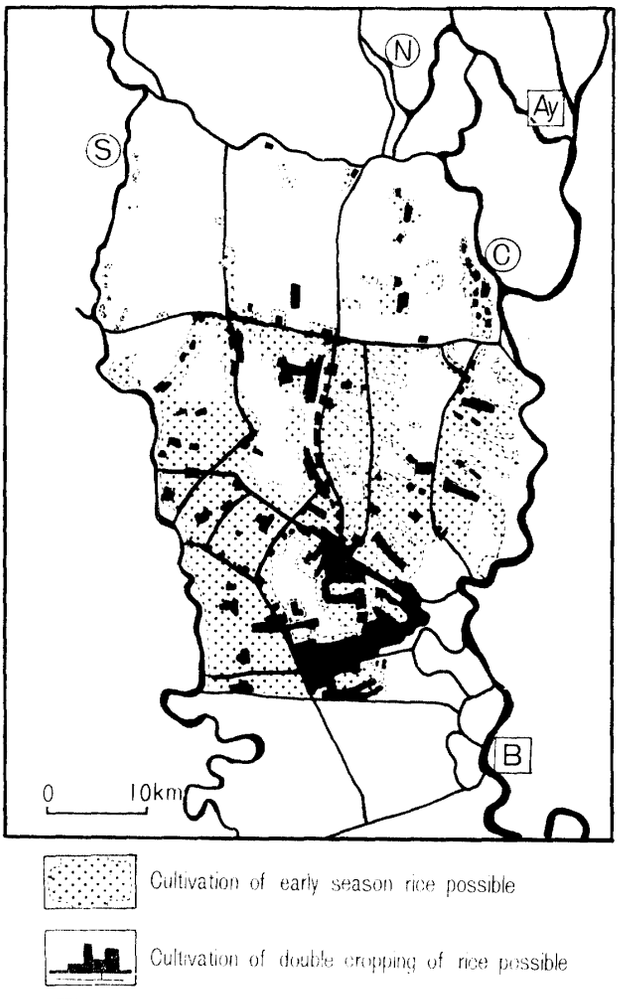


Fig. 4 Potential area to be planted with early season rice and double cropping of rice in the West Bank Tract

Source : Sukit Visuwan, RID

fairly well the general water conditions as described in the earlier section. It is in the transplanted rice area that a remarkable change of rice culture has, is, and will be occurring. The first evidence is the transfer of the season of rice growing from the main season to the early season, grown in between April-May-June and August-September. This change was caused, as explained in the previous section, by the availability of water in the dry season thanks to the implementation of water works and by the dissemination of low lift pumps. The second evidence is the introduction of double cropping of rice in certain acreages along the trunk canals as shown in Fig.4. The double cropping of rice demands assured irrigation and drainage in each plot of land. The map clearly indicates that such controllable water conditions are provided in the areas along the trunk canals. Third evidence is the relatively extensive dissemination of higher yielding varieties as RD varieties which require the application of commercial fertilizers and insecticides. Practically all of the early season

rice is of the RD varieties. Farmers' innovation to adapt to the new system of environment has taken place in the area where water is controllable to some extent.

But here note that the changing phase of the agricultural practices is taking place in a sharply restricted area along the major canals alone. This tendency would allow us to anticipate that denser canalization and empoldering schemes would make further contribution towards the total change of rice culture in the region.

Apart from rice cultivation, little change seems to be occurring especially in the living conditions of those delta dwellers, though roads may affect their commercial activities in certain areas as Sai Noi, Bang Bua Thong and Lat Lumkaeo. Easier mobility and easier accessibility to market centers by road networks would be the next necessary pre-condition for further change of agriculture in the region.

References

1) Kaida, Y. 1973. "A Subdivision of the Chao Phraya Delta Based on Hydrographical Conditions —Water Conditions in Deltaic Lowland Rice Fields (I)—," *Tonan Ajia Kenkyu* (Southeast Asian Studies), Vol. 11, No. 3, pp. 403–413.

2) Takaya, Y. 1974. "The Chao Phraya Delta in Thailand in the 21st. Century," (in Japanese). Ichimura, S. ed. *Critiques on Southeast Asia.* Tokyo : Sobunsha.

3) Royal Irrigation Department, Contour map of scale 1 : 200,000 for the region of the lower west bank of the Greater Chao Phraya Project.

4) Takaya, Y. 1973. "The Plant Height of Rice in Delta—A Case Study in the Chao Phraya Delta of Thailand," *Tonan Ajia Kenkyu* (Southeast Asian Studies), Vol. 11, No. 2, pp. 267–276.

5) Hubbard, R. V. 1967. The Canals of the Chao Phraya River Delta in Thailand. Master's thesis submitted to University of Michigan.

6) Tomosugi, T. 1967. "Historical Development of Irrigation and Drainage in the Chao Phraya Delta," Fujioka, Y. ed. *Water Resource Utilization in Southeast Asia.* pp. 165–176. Kyoto : Center for Southeast Asian Studies, Kyoto Univ.

7) Tanabe, S. 1973. "Historical Development of the Canal System in the Chao Phraya Delta, part I, and part II," (in Japanese) *Tonan Ajia Kenkyu* (Southeast Asian Studies), Vol. 11, No. 1, pp. 14–48; Vol. 11, No. 2, pp. 191–222.

8) Kaida, Y. 1974. "The Present State of Irrigation and Drainage in the Chao Phraya River Basin, and its Forthcoming Problems," (in Japanese) Ishii, Y. ed. *Thailand—A Rice Growing Country.* Tokyo : Sobunsha.

9) Ingram, J. C. 1971. *Economic Change in Thailand 1850–1970.* pp. 38–39. Stanford: Stanford Univ. Press.

10) Army Map Service of Thailand, Physiographic map of scale 1 : 50,000, surveyed in 1910's, and published in 1950's.

11) Sternstein, L. 1965, "Settlement Patterns in Thailand," *J. Tropical Geography.* Vol. 21, pp. 30–43.

12) Fukui, H. 1971. "Environmental Determinants Affecting the Potential Dissemination of High Yielding Varieties of Rice —A Case Study of the Chao Phraya River Basin—," *Tonan Ajia Kenkyu* (Southeast Asian Studies), Vol. 9, No. 3, pp. 348–374.

13) Takaya, Y. and E. Matsumoto. 1974. "Fai" and "Bo" Type Rice Culture in the Marginal Plain of Thailand," *Tonan Ajia Kenkyu* (Southeast Asian Studies), Vol. 11, No. 4, pp. 507–511

14) Fujioka, Y. and Y. Kaida. 1969. "Irrigation and Drainage in the Bangkok Plain," (in Japanese). *Tonan Ajia Kenkyu* (Southeast Asian Studies), Vol. 5, No. 3, pp. 572–600.

15) Sukit Visuwan. 1969. *West Bank Tract of the Mae Nam Chao Phraya Irrigation Project* (in Thai). Bangkok : RID.